CLAIMS

What is claimed is:

1. An optical apparatus, comprising:
   a) an input port, providing a multi-wavelength optical signal;
   b) a wavelength-disperser that separates said multi-wavelength optical signal by wavelength into multiple spectral channels having a predetermined relative arrangement;
   c) an array of beam-manipulating elements positioned to correspond with said spectral channels; and
   d) an optical detector;

   wherein said beam-manipulating elements are individually controllable, so as to direct said spectral channels into said optical detector in a time-division-multiplexed sequence.

2. The optical apparatus of claim 1 wherein said beam-manipulating elements comprise micromirrors.

3. The optical apparatus of claim 2 wherein said micromirrors comprise silicon micromachined mirrors.

4. The optical apparatus of claim 2 wherein each micromirror is pivotable about at least one axis.

5. The optical apparatus of claim 1 wherein said beam-manipulating elements comprise MEMS shutter-elements.

6. The optical apparatus of claim 1 wherein said beam-manipulating elements comprise liquid crystal shutter-elements.

7. The optical apparatus of claim 1 wherein said wavelength-disperser comprises an element selected from the group consisting of ruled diffraction gratings, curved diffraction gratings, holographic diffraction gratings, echelle gratings, transmission gratings, and dispersing prisms.

8. The optical apparatus of claim 1 wherein said optical detector comprises an element selected from the group consisting of PN photo detectors, PIN photo detectors, and avalanche photo detectors.

9. The optical apparatus of claim 1 wherein said input port comprises a fiber collimator, coupled to an input optical fiber transmitting said multi-wavelength optical signal.

10. The optical apparatus of claim 9 wherein said input optical fiber is a single mode fiber.

11. The optical apparatus of claim 1 further comprising a beam-focuser for focusing said spectral channels into corresponding focused spots that impinge onto said beam-manipulating elements.

12. The optical apparatus of claim 1 further comprising a reference signal, emerging from said input port along with said multi-wavelength optical signal; and a reference-position-sensing element, wherein said wavelength-disperser directs a reference spectral component of said reference signal to a predetermined location on said reference-position-sensing element.

13. The optical apparatus of claim 12 wherein said reference-position-sensing element comprises an element selected from the group consisting of position sensitive detectors, quadrant detectors, and split detectors.

14. The optical apparatus of claim 12 wherein said input port comprises a fiber collimator coupled to an input optical fiber, wherein said optical apparatus further comprises an

optical combiner for coupling a reference light source to said input optical fiber, and wherein said input optical fiber transmits said multi-wavelength optical signal and said reference light source provides said reference signal.

15. The optical apparatus of claim 12 further comprising an alignment-adjusting element for adjusting an alignment between said spectral channels and said beam-manipulating elements.

16. The optical apparatus of claim 15 wherein said beam-manipulating elements and said reference-position-sensing element form an optical-element array, and wherein said alignment-adjusting element comprises an actuation device coupled to said optical-element array, for causing said optical-element array to move.

17. The optical apparatus of claim 15 further comprising a processing element in communication with said alignment-adjusting element and said reference-position-sensing element, wherein said processing element monitors an impinging position of said reference spectral component onto said reference-position-sensing element and provides control of said alignment-adjusting element accordingly, so as to maintain said reference spectral component at said predetermined location, thereby ensuring a requisite alignment between said spectral channels and said beam-manipulating elements.

18. An optical apparatus, comprising:

a) an input port, providing a multi-wavelength optical signal;

b) a polarization-separating element that decomposes said multi-wavelength optical signal into first and second polarization components;

c) a polarization-rotating element that rotates a polarization of said second polarization component by approximately 90-degrees;

d) a wavelength-disperser that separates said first and second polarization components by wavelength respectively into first and second sets of optical beams;

e) a beam-focuser that focuses said first and second sets of optical beams into corresponding focused spots;

f) an array of beam-manipulating elements positioned to correspond with said first and second sets of optical beams; and

g) at least one optical detector;

wherein said beam-manipulating elements are individually controllable, such that first and second optical beams associated with each wavelength are directed into said at least one optical detector in a time-division-multiplexed sequence.

19. The optical apparatus of claim 18 wherein said beam-manipulating elements comprise micromirrors.

20. The optical apparatus of claim 19 wherein said micromirrors comprise silicon micromachined mirrors.

21. The optical apparatus of claim 19 wherein each micromirror is pivotable about at least one axis.

22. The optical apparatus of claim 18 wherein said beam-manipulating elements comprise liquid crystal shutter-elements.

23. The optical apparatus of claim 18 wherein said beam-manipulating elements comprise MEMS shutter-elements.

24. The optical apparatus of claim 18 wherein said polarization-separating element comprises an element selected from the group consisting of polarizing beam splitters and birefringent beam displacers.

25. The optical apparatus of claim 18 wherein said polarization-rotating element comprises an element selected from the group consisting of half-wave plates, liquid crystal rotators, and Faraday rotators.

26. The optical apparatus of claim 18 wherein said wavelength-disperser comprises an element selected from the group consisting of ruled diffraction gratings, holographic diffraction gratings, echelle gratings, curved diffraction gratings, transmission gratings, and dispersing prisms.

27. The optical apparatus of claim 18 wherein said beam-focuser comprises at least one focusing lens.

28. The optical apparatus of claim 18 wherein said input port comprises a fiber collimator.

29. The optical apparatus of claim 18 wherein said at least one optical detector comprises a single optical detector.

30. The optical apparatus of claim 18 wherein said at least one optical detector comprises first and second optical detectors, configured to receive said first and second sets of optical beams, respectively.

31. The optical apparatus of claim 18 wherein said at least one optical detector comprises at least one element selected from the group consisting of PN photo-detectors, PIN photo detectors, and avalanche photo detectors.

32. A method of spectral power monitoring using a time-division-multiplexed scheme, comprising:

a) providing a multi-wavelength optical signal;

b) separating said multi-wavelength optical signal by wavelength into multiple spectral channels; and

c) directing said spectral channels into an optical detector in a time-division-multiplexed sequence.

33. The method of claim 32 wherein said spectral channels are directed into said optical detector sequentially.

34. The method of claim 32 further comprising the step of grouping said spectral channels into a plurality of spectral sets, each containing one or more spectral channels, whereby said spectral sets are directed into said optical detector in said time-division-multiplexed sequence.

35. The method of claim 32 wherein said step c) is carried out by way of an array of micromirrors that are individually movable.

36. A method of optical spectral power monitoring, comprising:

a) providing a multi-wavelength optical signal;

b) decomposing said multi-wavelength optical signal into first and second polarization components;

c) rotating a polarization of said second polarization component by approximately 90-degrees;

d) separating said first and second polarization components by wavelength respectively into first and second sets of optical beams;

e) focusing said first and second sets of optical beams into corresponding focused spots;

f) impinging said first and second sets of optical beams onto an array of beam-manipulating elements; and

g) individually controlling said beam-manipulating elements, whereby first and second optical beams associated with each wavelength are directed into at least one optical detector in a time-division-multiplexed sequence.

37. The method of claim 36 wherein said at least one optical detector comprises a single optical detector, and wherein said step g) comprises directing said first and second

optical beams associated with each wavelength into said optical detector concurrently.

38. The method of claim 36 wherein said at least one optical detector comprises first and second optical detectors, and wherein said step g) comprises directing said first and second sets of optical beams into said first and second optical detectors, respectively.